DOCUMENT RESUME

ED 461 468 RC 023 362

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TITLE The 1998 High Schools That Work Assessment: Appalachian Regional Commission (ARC) Sites Are Improving. Research Brief.

INSTITUTION Southern Regional Education Board, Atlanta, GA.
PUB DATE 1999-00-00
NOTE 10p.
AVAILABLE FROM For full text: http://www.sreb.org/programs/hstw/publications/briefs/ResearchBrief14-Appalachian.pdf.
PUB TYPE Reports - Evaluative (142)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Achievement Gains; Educational Assessment; Educational Counseling; *Educational Improvement; *Educational Needs; High School Seniors; High Schools; Improvement Programs; Mathematics Achievement; Professional Development; Reading Achievement; *School Effectiveness; Science Achievement
IDENTIFIERS *Appalachia; *High Schools That Work

ABSTRACT

The 1998 High Schools That Work (HSTW) Assessment report contains good news for HSTW sites in the Appalachian Regional Commission area and provides information on specific practices that need improvement. This research brief summarizes the report's findings. Based on 196 schools in 9 Appalachian states, the report shows that school, district, and state efforts to use the HSTW school-improvement framework are succeeding. Between 1996 and 1998, Appalachian sites showed significant gains in 12th-graders' performance in reading, mathematics, and science. Gains in mathematics and science achievement were related to increased numbers of students completing the HSTW-recommended curriculum in mathematics and science. However, 36 percent of students at Appalachian sites read "below basic"--a level too low for success in a career-pathway job or further education. Appalachian sites scored lower than the 140 most-improved HSTW sites in 1998 in all three areas. Findings and recommendations are presented concerning six challenges facing Appalachian sites: improving the reading, mathematics, and science achievement of career-bound students; raising standards and the quality of instruction in career/technical courses; improving the quality of guidance services and making parents an active partner; and providing staff development to help teachers raise student achievement. (SV)

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ED 461 468

The 1998 *High Schools That Work* Assessment: Appalachian Regional Commission (ARC) Sites Are Improving

Research Brief

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U.S. DEPARTMENT OF EDUCATION
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HIGH SCHOOLS THAT WORK

Research Brief

SREB

The 1998 *High Schools That Work* Assessment: Appalachian Regional Commission (ARC) Sites Are Improving

by Gene Bottoms and Tom Feagin

The 1998 *High Schools That Work (HSTW)* Assessment report contains good news for *HSTW* sites in the Appalachian Regional Commission (ARC) area and provides information on specific school and classroom practices that need improvement. The report shows that school, district and state efforts to use the *HSTW* school-improvement framework are paying dividends. More career-bound[1] students are meeting the reading, mathematics and science performance goals and completing the *HSTW*-recommended academic core. The results are based on 196 schools in nine ARC states: Alabama, Georgia, Kentucky, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia.

ARC sites showed significant gains in 1998 in the performance of career-bound 12th-graders in reading, mathematics and science. The percentage of students meeting the *HSTW* performance goals[2] in 1996 and 1998 rose from 45 percent to 50 percent in reading, from 43 percent to 57 percent in mathematics and from 40 percent to 56 percent in science. In addition, the percentage of ARC students meeting the criteria for the *High Schools That Work* Award of Educational Achievement[3] grew from 16 percent in 1996 to 25 percent in 1998. Furthermore, the average reading, mathematics and science scores for both males and females improved between 1996 and 1998. (See Table 1.)

Table 1
Comparison of the Average Scores of Male and Female Students at Appalachian Regional Commission (ARC) Sites

	Reading		Mathematics		Science	
	1996	1998	1996	1998	1996	1998
Females	280	283	283	297	280	293
Males	264	271	282	299	285	295

1 Career-bound students are the 60 to 65 percent of high school seniors who plan to work, attend a two-year technical or community college, enroll in a four-year college or university with an open admissions policy, or enter the military after graduation.

2 The *High Schools That Work* Assessment is based on the National Assessment of Educational Progress (NAEP). The *HSTW* performance goals are 279 in reading, 295 in mathematics and 292 in science.

3 To qualify for the *HSTW* Award of Educational Achievement, students must score at or above the *HSTW* performance goals in reading, mathematics and science and complete four units in a vocational concentration and two of three components of the *HSTW*-recommended academic core.

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Table 2
Students' Average Scores at ARC Sites and at Most-improved *HSTW* Sites

	Reading		Mathematics		Science	
	Most-improved Sites	ARC Sites	Most-improved Sites	ARC Sites	Most-improved Sites	ARC Sites
1998	283	277	303	298	297	294
1996	270	272	283	283	281	282

Most-improved sites are the 140 *HSTW* sites that made the greatest gains in reading, mathematics and science achievement between 1996 and 1998.

The large increase in mathematics and science achievement occurred in part because more career-bound students completed the *HSTW*-recommended curriculum in mathematics and science. Seventy-five percent of the students completed the mathematics curriculum in 1998, compared with 58 percent in 1996. Fifty-six percent completed the science curriculum in 1998, compared with 37 percent in 1996. The good news is that the right mathematics and science courses do make a difference.

The bad news is that 36 percent of students at ARC sites read "below basic" — a level that is too low for success in a career-pathway job or further education. The low performance exists for two reasons: First, the majority of career-bound students are not allowed to take challenging language arts courses, and second, too few teachers engage students in using reading, writing and speaking skills. The reading problem is even more acute for male students, who scored 12 points lower than female students in 1998.

Forty-three percent of students failed to meet the mathematics goal in 1998, and 44 percent failed to meet the science goal. Too few students have access to the *HSTW*-recommended curriculum of high-level mathematics and science courses, and too few teachers use instructional strategies that engage students in learning challenging mathematical and scientific concepts.

The hope lies in knowing how to continue the progress of the last two years. ARC sites can advance achievement by studying and adopting practices used at most-improved *HSTW* sites that enroll students who are similar to those at ARC sites. Leaders and teachers at most-improved *HSTW* sites do more to make quality instruction and student learning the central focus. The ARC sites scored lower than the 140 most-improved *HSTW* sites in 1998 in all three areas — reading, mathematics and science — and did not improve as dramatically as the most-improved sites between 1996 and 1998. (See Table 2.)

HSTW sites in Appalachia can exceed the performance of the most-improved schools by teaching in ways that engage students in learning more complex academic and technical concepts. Giving students access to the right courses — taught in ways that motivate students to meet higher standards — is the single most powerful factor in raising student achievement. To get 85 percent of students at *HSTW* sites to meet or exceed the *HSTW* goals will require school and system leaders and teachers to address the following challenges:

Challenge 1: Improve the reading achievement of career-bound students.

Only about one-third of the ARC students took academic English courses in grades nine through 12. Twelve percent took Applied English 11, and 18 percent took Applied English 12. The percentage of students taking academic English courses did not increase significantly between 1996 and 1998. Considerably more than half of the students in grades nine through 12 took general English. Students who took general or applied English had average reading scores that failed to meet the *HSTW* goal. The good news is that the 36 percent of students who completed the *HSTW*-recommended English curriculum had an average score of 286, compared with 271 for those who did not complete the curriculum. Students who took rigorous English courses greatly exceeded the *HSTW* reading goal.

Another problem is that students are not being required to use language arts skills for learning in courses other than English. Students achieve at a higher level if they read three or more hours per week, read frequently in vocational classes, use word processing to complete written assignments, and read several books during the year. Only about half of the students who were assessed in 1998 had to write ideas in a journal frequently; only 42 percent were asked to write an in-depth explanation of a project or an activity frequently. ARC sites can take the following actions to raise reading achievement:

- Eliminate low-level English courses and give all students access to English courses benchmarked to college-preparatory standards. Schools can do so by benchmarking all English courses to standards such as those developed by the Council for Basic Education.[4]
- Prepare all teachers to use reading and writing for learning across the curriculum.
- Establish a climate of "inquiry" in all classrooms and make reading an important tool for asking questions and exploring topics.
- Engage students regularly in reading, writing, speaking, listening and thinking.
- Model for students how to acquire and organize information for recall and application.
- Organize students into small groups to interpret written materials and to analyze, synthesize and apply knowledge.
- Require students to defend — orally and in writing — their interpretations of what they have learned.
- Assign homework that requires students to reflect on what they learned in class.

Challenge 2: Improve the mathematics achievement of career-bound students.

Sixty-seven percent of students at most-improved *HSTW* sites completed college-preparatory Algebra I, compared with 61 percent at ARC sites. Seventy-nine percent at most-improved sites completed geometry, compared with 68 percent at ARC sites. Only 20 percent of students at most-improved sites took Technical Mathematics I, compared with 30 percent who took that course at ARC sites. Only 57 percent of the ARC *HSTW* students took mathematics in grade 12, compared with 63 percent at most-improved *HSTW* sites. The difference between ARC sites and most-improved sites in mathematics achievement is reflected in the higher percentage of students at most-improved sites who took college-preparatory-level courses. Students at all *High Schools That Work* sites who took four or more mathematics courses had an average score of 304, compared with 293 for those who took three courses.

More bad news is evident in the 90 percent of students at ARC sites who said they seldom or never presented a mathematics project in class and the 77 percent who said they seldom or never used a computer to complete a mathematics assignment. Of the 61 percent of students who completed college-preparatory Algebra I, only 10 percent were required to prepare a written report on a major mathematics project more than twice a year.

ARC sites can take the following actions to improve mathematics achievement:

- Support mathematics teachers in aligning the mathematics curriculum to the standards of the National Council of Teachers of Mathematics and in identifying courses that cover vital mathematics concepts.
- Provide staff development to prepare teachers to use authentic real-world problems in teaching mathematics concepts and procedures.
- Have all students complete four years of mathematics, including Algebra I, geometry, Algebra II and a higher-level mathematics course.
- Have all students take pre-algebra before grade nine.

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[4] The Council for Basic Education has developed rigorous language arts standards that include some specificity in the amount, complexity and variety of reading and writing that should be expected from students. These standards also emphasize higher-order thinking skills in relation to reading and writing.

- Support teachers in using a problem-solving approach to teach mathematics. The approach may involve:
  - posing a complex, thought-provoking problem;
  - letting students struggle with the problem;
  - asking students to present ideas or solutions to the class;
  - asking the class to discuss the solutions;
  - explaining the procedures that students could have used to solve the problem;
  - assigning homework that consists of complex, thought-provoking problems; and
  - requiring students at the conclusion of each major mathematics unit to define a career-related problem that can be solved by using the mathematics procedures being studied. Students should present the problem in writing, find a solution and prepare visuals to support an oral presentation of the problem and its solution.

Teachers need more time to plan learning experiences that will help students gain a deeper understanding of mathematics concepts and procedures.

Challenge 3: Improve the science achievement of career-bound students.

Seventy-one percent of the ARC students took three or fewer science courses. Twenty-nine percent completed college-preparatory biology, 50 percent completed chemistry, and only 12 percent completed physics. These percentages compare unfavorably with the percentages of students at most-improved sites, where 38 percent completed college-prep biology, 63 percent completed chemistry and 20 percent completed physics. Only 42 percent of students at ARC sites took science in their senior year, compared with 49 percent at most-improved sites.

The 56 percent of ARC students who completed the recommended science curriculum had an average score of 300, compared with 286 for those who did not complete the recommended curriculum. Teachers at ARC sites are not offering enough activities that motivate students to work harder to improve science achievement. For example, 76 percent of students at ARC sites seldom or never made a presentation about a science project, 64 percent seldom or never read a book or article about science, and 67 percent seldom or never prepared a written report on a science project. Sixty-one percent seldom or never completed a community-based science project.

Students who took science courses such as general science, environmental science, life science, earth science, basic physical science, basic biology, integrated science and applied biology-chemistry did not have average scores that met the *High Schools That Work* science goal. ARC schools need to review low-level courses and either upgrade or eliminate them.

ARC sites can take the following actions to improve science achievement:

- Support science teachers in aligning courses to national science standards and deciding which standards to address in each course.
- Require all students to complete three science courses, including at least two courses from college-preparatory biology, chemistry, physics, applied physics or anatomy and physiology.
- Benchmark all science courses to college-preparatory standards.
- Make all science courses inquiry- and lab-based so that students will spend more time "doing" science.
- Assign a laboratory experiment first so that students can "figure out" the answer rather than hear in advance what they are supposed to discover.
- Require all science students — individually and in groups — to conduct science projects that include:
  - identifying an "essential question" to study;
  - conducting background research and preparing a written report on the question;
  - stating an hypothesis;
  - designing and carrying out a study;
  - collecting, arranging, compiling, recording and synthesizing information;
  - preparing a written report; and
  - making an oral report with visuals.

Challenge 4: Raise standards and the quality of instruction in career/technical courses.

ARC sites made little progress in improving the quality of instruction in career/technical courses between 1996 and 1998. Courses that do the most to advance academic and technical learning require students to draw upon both academic and technical knowledge and skills in completing challenging, authentic assignments. Yet between 36 percent and 53 percent of students at ARC sites in 1998 said they seldom or never had to use reading, writing, mathematics or science knowledge and skills to complete vocational assignments. Students who used academic skills in vocational courses had significantly higher academic achievement.

At least half of students at ARC sites reported never or seldom having to perform tasks such as:

- reading, researching and synthesizing information from several documents into a written work plan, carrying out the plan and keeping a journal;
- making an oral report on a major project incorporating academic knowledge and skills;
- using a database or spreadsheet in a vocational assignment;
- revising work that has been assessed by an "outside expert" using workplace standards; and
- making a passing score on a comprehensive exam designed to assess students' 1) knowledge of technical subjects, 2) ability to read and interpret technical information and 3) ability to apply mathematical skills to solve problems from a student's chosen career field.

ARC site leaders and teachers can take the following actions to raise standards and improve the quality of instruction in career/technical courses:

- Ask each career/technical teacher to develop a detailed syllabus for each course. A syllabus should contain:
  - five to eight goals that reflect the teacher's vision of what students should know and be able to do as a result of the course;
  - a series of complex, authentic, open-ended projects involving related academic and technical instruction;
  - rubrics or guidelines for assessing projects and a clear statement of the basis for awarding grades; and
  - a requirement that students have to pass a written exam after each project. The purpose of the exam is to assess whether the project helped students learn related academic and technical knowledge and skills.
- Have each vocational teacher require a considerable amount of reading and writing weekly and at least one hour of homework to be done outside of class at least three times a week.
- Have each vocational teacher give a comprehensive end-of-course examination that includes the following three parts:
  - a project that assesses a student's ability to analyze a problem, use sound methods and apply appropriate technology to solve the problem;
  - a comprehensive written exam to measure a student's ability to read and interpret technical materials, to apply mathematical concepts and skills in solving problems from a career field of study, and to understand major technical concepts of the field; and
  - an oral exam during which a student makes a project presentation or answers questions from "experts" in the student's career field for 30 to 60 minutes. Students will be expected to demonstrate understanding of the career field and use appropriate technical language in answering questions.
- Arrange for teachers to spend time in a high-performance work environment in which they become part of a team that solves problems, does research, prepares written reports and makes oral reports to other team members. Many vocational teachers have never experienced the types of situations that give rise to authentic assignments. Vocational teachers need opportunities to put their academic skills to work in solving problems related to a career/technical specialty. (See *HSTW*'s Site Development Guide #8: *Teachers in the Workplace* for ideas on setting up an internship experience for vocational teachers.)

Challenge 5: Improve the quality of guidance services and make parents an active partner.

Guidance and advisement practices at the ARC sites improved between 1996 and 1998. Although the percentage of students who met with their parents and a counselor or a teacher-adviser to plan a program of study improved slightly, 72 percent of students did not participate in such a meeting. Twenty-eight percent of students in 1998 said they received no help from a counselor or a teacher-adviser in developing a program of study, and 32 percent said no one helped them review a planned program of study annually.

Students who received assistance in setting goals for further study — whether at a two-year or a four-year institution — had average scores that met *HSTW*'s performance goals in all three areas (reading, mathematics and science). On the other hand, students planning to work or attend a career/technical institution had average scores that fell short of the goals. ARC sites are not doing enough to ensure that career-bound students complete courses that prepare them for future study and/or career-pathway jobs.

A supportive guidance system is vital in raising student achievement. Students need opportunities to learn about their interests and aptitudes, available career fields, postsecondary education options and high school studies that will help them reach their goals. Career-bound students at high-achieving *HSTW* sites receive more-effective guidance services. As a result, they take more mathematics and science courses and complete a career concentration beyond an upgraded academic core.

When parents are involved in helping students set education and career goals and plan a program of study, students make better choices, take higher-level courses and achieve at a higher level.

High school leaders and counselors can take the following actions to improve guidance and advisement:

- Counsel students to take higher-level courses, especially in mathematics, science and English/language arts.
- Provide information about postsecondary education.
- Emphasize an upgraded academic core and a concentration for all students.
- Encourage students to take both academic and career/technical courses.
- Provide "reality checks" to help students and parents examine the gaps between a student's goals and his or her performance. A "reality check" can be a college or university entrance exam, an employer's job qualification exam or a work-site placement to give students and their parents an idea of the knowledge and skills needed for future success.
- Implement a strong teacher-adviser program to provide an adult mentor for each student.
- Make parents a partner in helping students set goals and plan to achieve them.
- Arrange for students and parents to meet with a teacher-adviser at least four times during high school. Schools should take the following actions:
  - Schedule a personalized meeting at the end of grade eight for a student, his or her parents and a counselor or a teacher-adviser to discuss a high school program of study. (See the box on page 7 for agenda items to cover at the first meeting.)
  - Conduct a second meeting of the student, his or her parents and a counselor or a teacher-adviser during the winter or spring of grade nine. Focus on planning a tentative five-year program of study for three years of high school and two years beyond.
  - Schedule the third meeting for the winter or spring of grade 10 to help the student choose an academic or career concentration for in-depth study. At this meeting, the student, his or her parents and a counselor or a teacher-adviser will discuss postsecondary options such as college, a technical school, an apprenticeship or the military. The discussion will include requirements for the SAT or ACT and other tests and the availability of scholarships and work-study programs. This meeting will include a review of the roles and responsibilities of the student, his or her parents and the school in preparing the student for work and/or further study after high school. It is also a good time to discuss the student's progress.

- Schedule the fourth meeting as a "reality check" in the winter or spring of grade 11. Review the student's program of study and determine whether the student needs to take more mathematics and/or science courses in grade 12 to prepare for a postsecondary goal. The school should impress upon parents and students the importance of taking solid academic courses along with career studies in the senior year to increase the potential for success in further study and the workplace.

Agenda Items for a Guidance Meeting with Eighth-Graders and Their Parents

- Courses that students take during grade nine
- Expectations for student learning in grade nine
- Actions by the school, students and parents in meeting high expectations
- The school's goal to prepare all students for the "next step" after high school by expecting them to complete a solid academic core and either an academic or a career concentration
- Extra-help services in grade nine to help students make a successful transition into rigorous high school studies
- Annual meetings to review a student's progress with parents and a counselor or a teacher-adviser and to make necessary revisions in the student's program of study
- Encouragement for parents to ask their children and the school for regular reports on their children's progress

Challenge 6: Provide staff development to help teachers raise student achievement.

Staff development on specific instructional approaches will improve student achievement. Teachers at the most-improved *HSTW* sites learned new ways to assess student progress, engage students actively in learning, and use student-centered and applied-learning strategies to teach conceptual understanding and problem-solving, as well as basic skills.

Vocational teachers at ARC sites are not receiving sufficient staff development on how to teach high-level mathematics, language arts and science skills. Sixty to 70 percent of vocational teachers have never participated in staff development on using and teaching mathematical or scientific skills, preparing a syllabus for teaching to higher standards, getting students to evaluate and redo their own work until it meets standards, or planning and using classroom assessment strategies to advance students' academic and technical achievement. Some vocational teachers doubt that they need staff development in these topics. However, the *HSTW* data tell another story. Students who said their vocational teachers often stressed reading, writing, mathematics and science had significantly higher average scores than students who said their teachers never stressed academic skills.

About 40 percent of teachers at ARC sites said they needed staff development on:

- involving students in the learning process;
- using real-world problems to teach mathematics;
- using reading and writing strategies to increase learning;
- engaging students in learning and "doing" science; and
- getting students to write reports and make oral presentations.

Many teachers at ARC sites are receiving support from the school board and system and school leaders to learn new ways to accelerate student learning. However, few teachers received the 40 hours of staff development in three years that they need to learn a new instructional strategy and to use it routinely in the classroom. About one-half of teachers received no staff development on upgrading subject-matter content or on using research-based, student-centered instruction.

District and school leaders at ARC sites can take the following actions to improve student learning through site-specific staff development:

- Address agreed-upon curriculum and instructional needs.
- Involve teams of teachers and school leaders in learning together with the help of an outside consultant.
- Develop understanding of new practices, demonstrate the desired practices, and provide coaching and peer support as teachers try new ideas and receive ongoing assessment and advanced training.
- Promote an environment in which teachers are expected to show evidence of improved student learning.
- Provide time for teachers to participate in study groups, cross-discipline visits and planning sessions to address student learning problems and effective instructional strategies.
- Help teachers use research-based teaching strategies. Examples are:
  - reading and writing across the curriculum;
  - project-based learning;
  - integrated academic and vocational instruction in which teachers work together to get students to learn essential academic and technical concepts;
  - groups in which students support and learn from each other;
  - authentic problems and projects that motivate students to learn academic and technical concepts; and
  - more-effective use of new and traditional assessment methods to improve instruction and to get students to demonstrate understanding of course standards.

Summary

Appalachian Regional Commission (ARC) schools made good progress between 1996 and 1998, but the 140 most-improved *High Schools That Work* sites provide evidence that ARC schools can do even better. If ARC school districts, schools and parents will strengthen their efforts to make student achievement the thing that matters most, they will continue to advance learning and increase students' opportunities for success after graduation.

Gene Bottoms is senior vice president of the Southern Regional Education Board. Tom Feagin is director of the *High Schools That Work* Appalachian initiative.